

## DESCRIPTION

### Background of Invention

#### **[Para 1] 1. Field of the Invention**

**[Para 2]** The invention relates to a clamp structure, and more particularly, to a clamp structure of an external electrode lamp.

#### **[Para 3] 2. Description of the Prior Art**

**[Para 4]** Most lamps used in TFT-LCD backlight modules today are cold cathode fluorescent lamps (CCFL) and the electrodes of these lamps are essentially sealed inside the lamp. The electrode however, also contains a conducting end that extends from the internal electrode to an external conducting wire, and eventually connects to a power supply to light the lamp.

**[Para 5]** The conducting end of the CCFL essentially needs to be connected via welding or a copper belt to the conducting wire. Nevertheless, welding or copper belting are both complicated processes that also bear high failure rates. For example, poor soldering often causes a so-called fake welding effect, in which the heat generated during lighting will produce temperature high enough to melt the solder of the section where the conducting end is connected to the conducting wire and eventually results in a broken circuit. If the excess solder of the section between the conducting end and the conducting wire is poor, an electric discharge often results and causes serious scorch or electric leakage. On the other hand, if copper belting is used, electric

discharge at the four corners of the copper belt has to be considered carefully, and in general, an additional insulated heat-shrink tube is added to cover the external area of the copper belt which unavoidably results in extra cost.

[Para 6] Taiwan Patent No. 00540745 provides a backlight device that includes a set of lamps located inside a main structure in which each of the lamps contains a conducting end that extends from the internal lamp. The main structure includes a plurality of supporting devices in which each of the devices contains a hole that is capable of holding a lamp and one conducting part that connects mechanically as well as electrically to the conducting end of the lamp. Despite the fact that this patent design could essentially solve the problems discussed previously, the luminosity and life expectancy of the lamp have been strongly challenged as the development of backlight lamp advances and as the size of LCD panel increases. In order to cope with these challenges, the external electrode fluorescent lamp (EEFL) has been introduced to the market.

[Para 7] The EEFL is a type of illuminating device for transforming electrical energy released via high frequencies into light energy. In contrast to other fluorescent lamp that uses the electrode to transform external electrical energy to the energy needed by the lamp, the EEFL utilizes the principle of electromagnetic induction and a pair of metal electrodes covering the lamp to generate an induced current internally. The pair of metal electrodes covering the lamp is essentially being used as a primary coil of an adapter whereas the lamp is being used as a secondary coil of an adapter.

[Para 8] Under the same electrical current, the luminosity of the light produced by the external electrode lamp is essentially higher than that produced by the cold cathode fluorescent lamp. As a result of rapid advancement in the EEFL and its inverter manufacture technology, the external electrode lamps have been gradually adopted into the TFT-LCD backlight modules. Moreover, the life expectancy of external electrode lamps is also

significantly longer than cold cathode fluorescent lamps in that CCFL generally lasts 60,000 hours whereas the EEFL is able to last 80,000 to 100,000 hours.

[Para 9] Despite the fact that the EEFL in general exhibits greater efficiency over CCFL, it still has some disadvantages. During regular testing, as the electrode of the EEFL is constantly driven by high voltages and exposed to the outside environment, numerous electric shocks would frequently take place. In addition, the layout of the electrode power supply resulting from stabilizing the external electrode lamp in position also places various limitations on the shock resistance design. Consequently, many of the EEFL products sold in the market today still suffer from problems such as poor electrode cladding or poor shock resistance.

#### Summary of Invention

[Para 10] It is therefore an object of the claimed invention to provide a clamp structure of an external electrode lamp with excellent wrapping and cushioning capability to solve the problems stated previously.

[Para 11] According to the claimed invention, the clamp structure of the external electrode lamp includes a first fixing device, a second fixing device, and a metal strip. The first fixing device includes at least a first indentation and the second fixing device includes at least a second indentation for clamping an electrode of the external electrode lamp. In addition, the metal strip is located between the first and second fixing devices to contact the electrode of the external electrode lamp for providing power. The electrode can be further equipped with a cushion for fixing the electrode onto the first and second fixing devices.

[Para 12] According to the claimed invention, the clamp structure is applicable in a backlight module, which includes an external electrode lamp,

an inverter, and the clamp structure wherein the inverter is used for providing power to the external electrode lamp and the clamp structure is for holding the external electrode lamp. The clamp structure includes a first fixing device, a second fixing device, and a metal strip. The first fixing device includes at least a first indentation and the second fixing device includes at least a second indentation for clamping an electrode of the external electrode lamp. In addition, the metal strip is located between the first and second fixing devices to contact the electrode of the external electrode lamp for providing power. The electrode can be further equipped with a cushion for fixing the electrode onto the first and second fixing devices.

[Para 13] It is an advantage of the present invention that the clamp structure provides distinguishing features including well adapted cladding ability and strong resistance to shocks and impacts, thereby effectively increasing the safety and reliability of the product.

[Para 14] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

#### Brief Description of Drawings

[Para 15] Fig. 1 is a diagram illustrating a clamp structure of an external electrode lamp according to the present invention;

[Para 16] Fig. 2 is a diagram illustrating a clamp structure of an external electrode lamp according to another embodiment of the present invention; and

[Para 17] Fig. 3 is a diagram illustrating a backlight module according to the present invention.

## Detailed Description

**[Para 18]** Please refer to Fig. 1. Fig. 1 is a diagram of a clamp structure of an external electrode lamp according to the present invention. As shown in Fig. 1, a clamp structure 100 includes a base 102, a metal strip 104, and a row of metal clipping channel 106. The entire row of metal clipping channel 106 is fixed in place by the metal strip 104 and when an external electrode lamp 108 is installed into the clamp structure 100, a parallel connection will be established. The connection between the external electrode lamp 108 and the clamping structure 100 is essentially achieved by installing and clamping the electrode 110 of the external electrode lamp 108 into the metal clipping channel 106 via its metal elasticity. The metal strip 104 is then electrically connected to an inverter (not shown) for providing power from the inverter to each metal clipping channel 106. By contacting the external electrode lamp 108 with the metal clipping channel 106 directly, the power can be delivered smoothly from the metal strip 104 to the external electrode lamp 108 to form a complete parallel circuit.

**[Para 19]** Please refer to Fig. 2. Fig. 2 is a diagram of a clamp structure of an external electrode lamp according to another embodiment of the present invention. As shown in Fig. 2, a clamp structure 200 includes a first fixing device 202, a second fixing device 204, and a metal strip 206, wherein the first fixing device 202 further includes a plurality of first indentations 212 and the second fixing device 204 further includes a plurality of second indentations 214. The first indentation 212 and the second indentation 214 are used for clamping an external electrode 210 of an external electrode lamp 208. In addition, the metal strip 206, located between the first fixing device 202 and the second fixing device 204, includes an electrical junction 207 that is electrically connected to the external electrode 210 of the external electrode lamp 208 for providing power. During usage, the metal strip 206 is positioned on the first fixing device 202 or the second fixing device 204 and the external electrode 210 of external electrode lamp 208 is placed on the metal strip 206.

The metal strip 206 is then connected to an inverter (not shown) for providing power to the external electrode 210.

[Para 20] The first fixing device 202 and the second fixing device 204 can be made of plastic or other insulating materials such as bakelite. The metal strip 206 can be either bent according to the shape of the second indentation 214, as is shown in Fig. 2, or bent according to the shape of the first indentation 212, to form the electrical junction 207, so that the metal strip 206 can be tightly connected to each of the indentations 212, 214. Essentially, the bending radius or curvature of the electrical junction 207 needs to be slightly less than the radius or curvature of the first indentation 212 or the second indentation 214. In addition, a protruding structure (not shown) can be added on the first indentation 212 or the second indentation 214 so that when the clamp structure 200 is assembled, the metal strip 206 is connected much more tightly with the external electrode 210. In order to enhance the installation of the metal strip 206 into the first indentation 212 or the second indentation 214 more easily, a bevel can be added on the first indentation 212 or the second indentation 214. When the metal strip 206 is placed into the first indentation 212 or the second indentation 214, accessories such as screws or tenons are used to fix the metal strip 206 in place.

[Para 21] In order to increase the shock resistance of the external electrode lamp 208 and the clamp structure 200, a cushion 216 is added around the external electrode lamp 208 during assembly. Positioned between the external electrode 210 and the first fixing device 202 or the second fixing device 204, the cushion 216 can be made of rubber or other shock-absorbing materials with strong elasticity.

[Para 22] When the external electrode lamp 208 is assembled onto the clamp structure 200, the external electrode 210 is able to prevent shakes from the clamp structure 200 from damaging the external electrode lamp 208 by contacting the cushion 216 with the first fixing device 202 or the second

fixing device 204. In addition, the cushion 216 also provides a fitting function in the horizontal direction to prevent the external electrode lamp 208 from sliding on the first indentation 212 or the second indentation 214. In effect, a better design of the cushion area could include an expansion area to the space where the first indentation 212 or the second indentation 214 corresponds to the cushion 216 or a tip section 218 of the extremity of the external electrode 210. More notably, the tip section 218 can be made of elastic materials such as plastic or sponges that are capable of enhancing the ability of shock absorbance and impact resistance. Moreover, the tip section 218 can be made in various shapes like caps, circles, or flakes according to each product specification. When the external electrode lamp 208 is put in place into the clamp structure 200, the first fixing device 202 and the second fixing device 204 can be fixed in position via screws or tenons.

[Para 23] Please refer to Fig. 3. Fig. 3 is a diagram of a backlight module according to the present invention. As shown in Fig. 3, a backlight module 300 includes a combined structure of the clamp structure 200 and the external electrode lamp 208 stated previously and an inverter 302. By completely covering the external electrode 210 with the first fixing device 202 and the second fixing device 204, the backlight module 300 is able develop a well adapted electrode cladding ability to prevent electric shocks. In addition, the backlight module 300 also provides good shock absorbance and impact resistance by contacting the external electrode 210 with the first fixing device 202 or the second fixing device 204 via the cushion 216. The installation of the external electrode 210 of the external electrode lamp 208 into the clamp structure 200 is essentially established by clamping the external electrode 210 with the first fixing device 202 and the second fixing device 204. The metal strip 206 on the other hand, is electrically connected to the inverter 302 for providing power from the inverter 302 to each external electrode 210. By contacting the external electrode 210 of the external electrode lamp 208 with the metal strip 206 directly, power can be delivered smoothly to the external electrode lamp 208 to form a complete parallel circuit. A backboard 304

capable of reflecting light is also added underneath the backlight module 300 to direct the light sent out by the backlight module 300 to the upper direction.

[Para 24] In contrast to the prior art, the present invention introduces the clamp structure of the external electrode lamp to provide distinguishing features including well adapted cladding ability and strong resistance to shocks and impacts, thereby effectively increasing the safety and reliability of the product.

[Para 25] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.